

Isobaric Heat Capacity of Liquid Ethanol at Temperatures between 265 K and 348 K

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We measured isobaric heat capacities of liquid ethanol with high reliability. Our group constructed a flow-calorimeter in 1996 for measuring specific heat-capacity at constant pressure for HFC liquid refrigerants. In 2008, Suzuki reconstructed the apparatus of a flow calorimeter with an improvement for achieving a stable mass-flow-rate by introducing plastic accumulators. We confirmed that the apparatus is able to measure isobaric heat-capacities with an immeasurable level of heat loss, and repeatability within the uncertainty under simple operation. Isobaric-heat-capacity measurement was applied to liquid ethanol. The measurements were obtained at 22 state points, a pressure of 500 kPa, with a temperature range from 265 K to 348 K. The expanded uncertainty (coverage factor of $k = 2$) in heat capacity measurements is predicted to be from 0.56 % to 0.90 % . In order to provide reliable experimental data, we measured for two different samples of ethanol supplied from two different manufacturers. The purities of the sample liquid ethanol were reported as better than 99.95 % and 99.9 % in mass fraction by respective manufacturers. Measured values for the different samples agree within the predicted uncertainty. In addition, isobaric heat-capacities of liquid ethanol at pressures of 500 kPa, 1 MPa, and 1.5 MPa were measured at a temperature of 320 K to confirm the pressure dependency of the heat capacity. Although we believe that our measurements provide the most accurate heat-capacity values for liquid ethanol, existing measurements by other researchers and derived specific-heat-capacity values from an equation of state developed by Dillon and Penoncello show greater values by more than ten percent in the worst case. Careful treatment for acquiring reliable thermophysical properties is requested for users of isobaric-heat-capacity data, and a new thermodynamic equation of state is requested for liquid ethanol.